



Public Buildings Enhanced Energy Efficiency Program

**SCREENING RESULTS FOR
MINNESOTA WEST COMMUNITY AND TECHNICAL
COLLEGE- WORTHINGTON CAMPUS**



Minnesota
STATE COLLEGES
& UNIVERSITIES

June 17, 2011

Campus Overview

Minnesota West Community and Technical College- Worthington	
Location	1450 Collegeway, Worthington, MN 56187
Facility Manager	Gordon Heitkamp Building Maintenance Foreman
Number of Buildings	5
Interior Square Footage	144,735 (from B3)
PBEEEP Provider	Center for Energy and Environment (Angela Vreeland)
Date Visited	4/21/2011
Annual Energy Cost	\$172,840 (from 2010 utility data)
Utility Company	Electric: City of Worthington Natural Gas: Minnesota Energy Resources
Site Energy Use Index (EUI)	85 kBtu/sqft (from 2010 utility data)
Benchmark EUI (from B3)	115 kBtu/sqft

Minnesota West Community and Technical College in Worthington is comprised of five detached buildings. Four of the buildings are classroom or administrative buildings and one is a small storage building. There is an enclosed and heated walkway, called the Link, which connects three of the buildings on campus. A map of the campus can be found at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of Minnesota West Community and Technical College in Worthington was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on April 21, 2011 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

An investigation of the energy usage and energy savings opportunities of the campus is not recommended at this time. The table below lists the buildings located on campus, which includes additions to the five main buildings and the link. The floor areas listed in the table have not been verified.

Building Name	State ID	Building	Area (sq ft)	Year Built
Activities Building	E26146C0268	Activities	19,653	1968
Addition to LRC	E26146C0702	Ag-Bldg/LRC	6,775	1992
Administrative/Classroom	E26146C0165	Admin/Classroom	51,450	1965
Ag-Bldg/LRC	E26146C0475	Ag-Bldg/LRC	27,600	1975
Field House Annex	E26146C0804	Activities	9,800	2004
Fine Arts	E26146C0371	Fine Arts	17,513	1971
Link	E26146C0695	N/A	7,100	1995
New Entrance/Student Services	E26146C0805	Admin/Classroom	3,500	2005
Storage Building	E26146C0580	Storage	1,344	1980

There are many factors that are part of the decision to recommend an energy investigation of a building; at Minnesota West Worthington some of the characteristics that would indicate the campus is a good candidate for recommissioning are:

- Level of control by the building automation system
- Equipment size and quantity
- Support from the staff and management to include building in an investigation

Although the building staff are supportive of an energy investigation and would like to further reduce energy use at their campus, the energy use at the site is simply too low for a recommissioning study to be certain of delivering cost-effective savings. Recommissioning is focused on low-cost and no-cost measures that typically involve control changes and other minor adjustments to equipment operation. The Energy Use Index (EUI) for the entire campus is 85 kBtu/sqft. This is a low EUI and indicates that the staff has already identified the majority of short payback items. Therefore, the likelihood of finding energy efficiency measures for this site that will be cost effective is unlikely.

Potential Energy Reduction Measures and Existing Problems

During the screening process it was noted that there were a number of Return Air CO2 sensors that were out of calibration.. Repairing these will help insure proper operation of the HVAC system.

Building Descriptions

Details obtained through the screening process regarding the buildings on campus are included in the following:

Mechanical Equipment

There are a total of 12 air handlers located throughout the five buildings on campus. All of the air handlers are constant volume except two. One variable air volume (VAV) air handler is located in Administration/Classroom Building and serves 56 VAV boxes. The other VAV air handler is located in the Ag Building/LRC and serves 30 VAV boxes.

There are a total of seven hot water boilers throughout campus. With the exception of the Fine Arts Building and the Storage Building, each building has two hot water boilers. The Fine Arts Building has one boiler that never operates and is on standby, so that building gets its hot water from the Administration/Classroom Building. The Storage Building is neither heated nor cooled.

Three of the buildings on campus have an air-cooled chiller, the Classroom/Admin Building, Fine Arts, and the Ag Building/LRC. The Activities Building is not cooled.

A Guaranteed Energy Savings contract with Johnson Controls went from 2002 to 2011. As a result, a building automation system was installed in 2003 and other work was completed at other Minnesota West campuses including adding roof insulation and replacing rooftop units.

The following table lists the key mechanical equipment on campus.

Mechanical Equipment Summary Table	
1	Building Automation System (Johnson Controls Metasys)
5	Buildings
144,735	Interior Square Feet
12	Air Handlers
86	VAV Boxes
~16	Exhaust Fans
16	Unit Heaters and Cabinet Unit Heaters
3	Chillers
7	Hot Water Boilers
22	Pumps (HW, CHW, etc)

Controls and Trending

The mechanical equipment is controlled by a Johnson Controls Metasys Building Automation System (BAS), which was installed in 2003. The system is capable of trending and the trend data can be exported from the BAS in a usable format for spreadsheet analysis. The majority of the equipment on campus is digitally controlled and on the automation system.

Lighting

The majority of interior lighting on campus is 32 watt T8s and as the lamps burn out they are being replaced with 28 watt T8s. All of the interior lights are automated.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) for the campus is 85 kBtu/sqft. This is 26% lower than the B3 Benchmark of 115 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. This indicates that Minnesota West-Worthington does not have as much potential to further reduce its energy use as other State buildings.

Metering

The campus has one electric and seven natural gas meters. None of the buildings are individually metered because they all share an electric meter.

Documentation

There is a significant amount of mechanical documentation, including building plans and equipment schedules available on-site. There is a Performance Contract Proposal that was prepared by Johnson Controls in 2002 that contains useful information about the equipment on campus.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-throughs, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

Activities Building & Field House					
State ID# E2614C0804, E2614C0268					
Area (sqft)	29,453	Year Built	1968/2004	Occupancy (hrs/yr)	4,090
HVAC Equipment					
Air Handlers (3 Total)					
Description	Type	Size	Notes		
AH-1	CV AHU with SF	18,900 cfm	Serves Main Gym		
AH-2	CV AHU with SF	Unknown	Gym Dehumidification		
AH-3	CV AHU with SF	1,500 cfm	Serves Wrestling		
Heating System					
Description	Type	Size	Notes		
Blr 1	Fulton Condensing	1,490 MBH			
Blr 2	Boilers	each			
Blr Pump 1	HW Pumps	¾ hp each	Serve Boilers		
Blr Pump 2					
Pump 1	HW Pumps	5 hp each			
Pump 2					
Exhaust Fans (5 Total)					
Description	Type	Size	Notes		
EF1-5	Exhaust Fans	500-4,410 cfm each			
Points on BAS					
Air Handlers					
Description	Points				
AH-1	Relief damper open/close, Global OAT, Econ damper, MAT, Face/bypass damper, Zone temp setpoint, Zone temp, DAT, SF command, Unocc/Occ				
AH-2	Global OAT, Zone temp, Zone RH, Zone temp setpoint, Zone RH setpoint, Reheat DAT, Cooling DAT, Unocc/Occ, DX cooling stage (4), SF command, Electric reheat stage (4)				
AH-3	Global OAT, Econ damper, MAT, Face/bypass dampers, Unocc/Occ, Zone temp setpoint, Zone temp, DAT, SF command				
Heating System					
Description	Points				
Heating System	Lowest space temp, HWST setpoint, HWST, OAT, Plant enable OA setpoint, Boiler pump status (2), Boiler fuel status (2), Boiler modulation (2), Boiler control (2), HWRT, HW pump status (2), Boiler lead/lag, HW pump lead/lag				
Exhaust Fans					
Description	Points				
EFs	EF command				

Administration/Classroom Building

State ID# E2614C0165, E2614C0805

Area (sqft)	54,950	Year Built	1965/2005	Occupancy (hrs/yr)	4,368
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HVAC Equipment**Air Handlers (3 Total)**

Description	Type	Size	Notes
AHU-1	VAV Dual Duct AHU with 1 RF and 2 SFs	23,000 cfm	2 nd Floor
AHU-2	CV Dual Duct AHU with SF	15,000 cfm	1 st Floor
AHU-4	CV AHU with SF	7,400 cfm	Cafeteria/ Kitchen

VAV Boxes (56 Total)

Description	Type	Size	Notes
VAV 101-127, 201-229	VAV reheat boxes	490 – 3,135 cfm	

Cooling System

Description	Type	Size	Notes
Chiller	Chiller	200 tons	
Pump 1 Pump 2	Variable Volume CHW Pumps	20 hp each	

Heating System

Description	Type	Size	Notes
B1	Fulton Condensing HW Boiler	2,000 MBH	Serve Admin/Classroom and Fine Arts
B2	LES HW Boiler	3,680 MBH,	Serve Admin/Classroom and Fine Arts
P1 P2	Variable Volume HW Pumps	15 hp each, 325 gpm each	Send HW to Admin/Classroom
P3	Constant Volume HW Pump	3 hp, 200 gpm	Serves Boiler B1
P4 P5	Constant Volume HW Pumps	5 hp each	Send HW to Fine Arts

Cabinet Unit Heaters (4 Total)

Description	Type	Size	Notes
CUH1	Cabinet Unit Heater	550 cfm, 37,200 MBH	West Entry
CUH2	Cabinet Unit Heater	520 cfm, 37 MBH	Entry by Boiler
CUH3 CUH4	Cabinet Unit Heaters	240 cfm each, 15 MBH each	Entry by Office

Exhaust Fans (3 Total)

Description	Type	Size	Notes
PRV1	Power Roof Vent	800 cfm	
PRV2	Power Roof Vent	800 cfm	
PRV3	Power Roof Vent	800 cfm	

Hot Water Perimeter Radiation

Points on BAS- Admin/Classroom Building

Air Handlers

Description	Points
AHU-1	RF Plenum Pressure, Ret Fan Bypass Damper, Econ Damper, RA RH, RAT, RF status, SF1A status, SF1A Speed, SF1A cfm, RF cfm, RF Speed, MAT, DA DSP, Heating valve, Cooling valve, SF1B cfm, DAT, SF1B status, SF1B speed
AHU-2	RA RH, RAT, MAT, DAT, OA damper, Cooling valve, SF status, Heating valve, Zone temp, Cooling setpoint, Heating setpoint
AHU-4	Global OAT, RA CO2, Zone temp setpoint, Zone temp, Commons Restroom EF, Econ damper, MAT, Unocc/Occ, DAT, DAT setpoint, SF command, Heating valve, DX cooling 1, DX cooling 2

Cooling System

Description	Points
Cooling System	OAT, Chiller On/Off, CHW pump status (2), CHW pump speed (2), CHW DP, OAT enable setpoint

Heating System

Description	Points
Heating System	Plant enable OA setpoint, System DP, Radiation valve to Admin Bldg open/close, System DP setpoint, OAT, HWRT, Radiation lockout, HW pump status (4), P1 and 2 speed, P1 lead/lag, P4 lead/lag, Unocc/occ, HWST, HWST setpoint, Boiler status (2), Boiler % modulation (2), Average room radiation setpoint, Valve to Fine Arts and Link

Exhaust Fans

Description	Points
EFs	Chemistry space static pressure, Biology space static pressure, Bio/Chem prep space static pressure, DA DSP setpoint (2), DA DSP, VFD speed (2)

Fine Arts					
State ID# E2614C0371					
Area (sqft)	17,513	Year Built	1971	Occupancy (hrs/yr)	3,861
HVAC Equipment					
Air Handlers (5 Total)					
Description	Type	Size	Notes		
AH-1	Multizone AHU with SF	12,200 cfm	Serves Stage		
AH-2	CV AHU with SF	11,500 cfm	Serves Auditorium		
AH-3	Multizone AHU with SF	7,700 cfm	Serves Band Area		
AH-4	Multizone AHU with SF	5,500 cfm	Serves Art Area		
AH-5	CV AHU with SF	1,500 cfm	Serves Office Area		
Cooling System					
Description	Type	Size	Notes		
Chiller	Chiller	100 tons			
CP-1	Variable Volume CHW	7.5 hp each			
CP-2	Pumps				
Heating System					
Description	Type	Size	Notes		
Boiler	Fulton condensing HW boiler	2,000 MBH	Standby only		
HP-1	Constant Volume HW Pump	7.5 hp	Send HW to Fine Art Bldg, on standby with Boiler		
Exhaust Fans (4 Total)					
Description	Type	Size	Notes		
EF 1-4	Exhaust Fans	200 – 2,400 cfm			

Points on BAS- Fine Arts

Air Handlers

Description	Points
AH-1	Global OAT, RAT, RA CO2, Unocc/Occ, Econ damper, MAT, SF command, Heating valve, HDT, Cooling valve, CDT, Zone temps (3), Zone temp setpoints (3), Zone dampers (3)
AH-2	Global OAT, RAT, RA CO2, Zone temp setpoint, Zone temp, Econ damper, Unocc/Occ, Face/Bypass damper, MAT, DAT, DAT setpoint, SF command, CHW valve
AH-3	Global OAT, RA CO2, RAT, Toilet EF command, Econ damper, MAT, SF command, Unocc/Occ, Heating valve, HDT, Cooling valve, CDT, Zone temps (3), Zone temp setpoints (3), Zone dampers (3)
AH-4	Global OAT, RAT, RA CO2, Occ, Econ damper, MAT, SF command, HDT, Heating valve, CDT, Cooling valve, Zone temps (2), Zone temp setpoints (2), Zone dampers (2)
AH-5	Global OAT, RAT, RA CO2, Zone heating setpoint, Zone cooling setpoint, Zone temp, Unocc/Occ, Econ damper, MAT, Face/Bypass damper, DAT, SF command, Heating DAT setpoint, DX cooling on/off

Cooling System

Description	Points
Cooling System	Chiller status, CHWRT, CHWST, Link F/A Heat/Cool switch setpoint, OAT, CHW pump lead/lag

Heating System

Description	Points
Heating	<i>No Points Available</i>

Exhaust Fans

Description	Points
EFs	<i>No Points Available</i>

Ag Bldg/Information Resource Center (IRC)

State ID# E2614C0702, E2614C0475

Area (sqft)	34,375	Year Built	1975/1992	Occupancy (hrs/yr)	3,900
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HVAC Equipment**Air Handlers (1 Total)**

Description	Type	Size	Notes
AH-1	VAV AHU with SF and RF	32,700 cfm	

VAV Boxes (30 Total)

Description	Type	Size	Notes
VAV 1-30	VAV reheat boxes	60 - 2,010 cfm	

Heating System

Description	Type	Size	Notes
Boiler 1	Fulton condensing HW boiler	1,290 MBH each	
Boiler 2			
Blr Pump 1	Constant Volume HW Boiler Pumps	<1 hp each	Serve Boilers 1 and 2
Blr Pump 2			
Pump 1	Constant Volume HW Pumps	10 hp each, 260 gpm each	
Pump 2			
Pump 5	Constant Volume HW Pumps	2 hp each, 43 gpm each	
Pump 6			

Cooling System

Description	Type	Size	Notes
IRC Chiller	Air-cooled chiller	82 ton	
P3	CHW Pumps	5 hp each, 176 gpm each	
P4			

Exhaust Fans (4 Total)

Description	Type	Size	Notes
EF 41-43	Exhaust Fans	160 - 720 cfm	

Hot Water Perimeter Radiation

Points on BAS- Ag Bldg/IRC**Air Handlers**

Description	Points
AH-1	Global OAT, Return plenum pressure, Main library temp, RAT, Main library RH, RA CO2, RF VFD speed, Relief/exhaust damper, Econ switchover OAT setpoint, Econ damper, MAT, Heating valve, Cooling valve, SF VFD Speed, SF command, Unocc/Occ, Bldg static pressure, DA DSP, DAT, DAT setpoint

VAV Boxes

Description	Points
VAVs	<i>No Points Available</i>

Heating System

Description	Points
Heating System	OAT, HWRT, P1 lead/lag, P5 lead/lag, OA heating setpoint, HWST, Boiler HWST (2), Boiler pump status (2), OA heating setpoint, Calculated HWST setpoint, Day/Night, Boiler command, HWST Reset %

Cooling System

Description	Points
Cooling System	Chiller stages (6), CHWST setpoint, CHWST, CHWRT, Pump 3 lead/lag, Chiller enable on/off

Exhaust Fans

Description	Points
EFs	EF command

Link

State ID# E2614C0695

Area (sqft)	7,100	Year Built	1995	Occupancy (hrs/yr)	3,120
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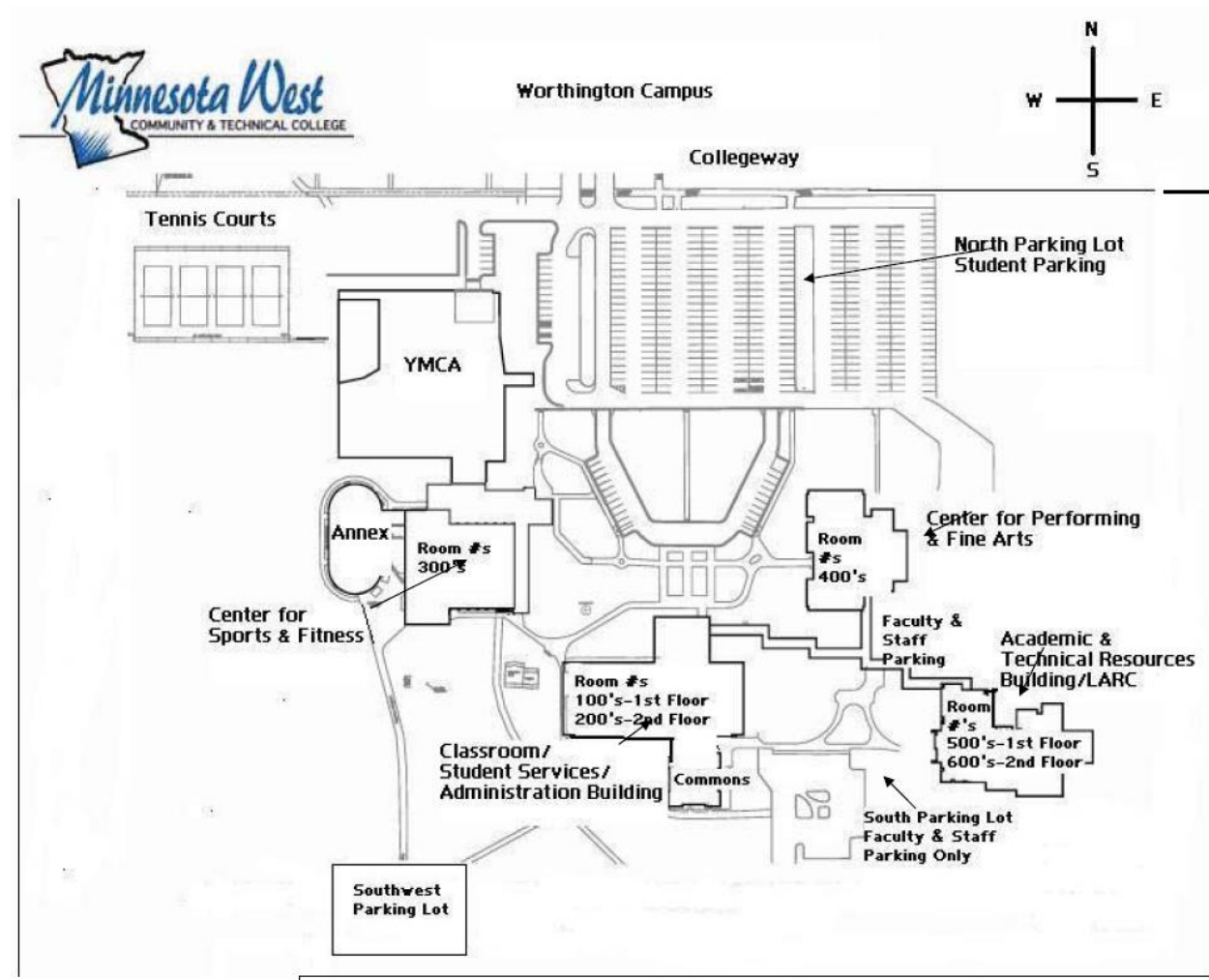
HVAC Equipment**Fan Coil Unit (12 Total)**

Description	Type	Size	Notes
FC-5 - 16	Fan Coil Units	Unknown	

Points on BAS**Fan Coil Units**

Description	Points
FCU	Space temp

Campus Map



PBEEP Abbreviation Descriptions			
AHU	Air Handling Unit	hp	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
cfm	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH